(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 036 295**
A2

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: 81301030.3

(51) Int. Cl.³: B 41 J 3/04

(22) Date of filing: 12.03.81

(30) Priority: 14.03.80 GB 8008794

(43) Date of publication of application:
23.09.81 Bulletin 81/38

(84) Designated Contracting States:
AT BE CH DE FR GB IT LI LU NL SE

(71) Applicant: PRINTOS B.V.
Energiestraat 1-3 P.O. Box 5029
NL-1410 AA Naarden(NL)

(72) Inventor: Cross, Grant Paterson
M/V Dimcyl Harefield Road
Rickmansworth Hertfordshire(GB)

(74) Representative: Sheader, Brian N. et al,
ERIC POTTER & CLARKSON 5 Market Way Broad Street
Reading Berkshire, RG1 2BN(GB)

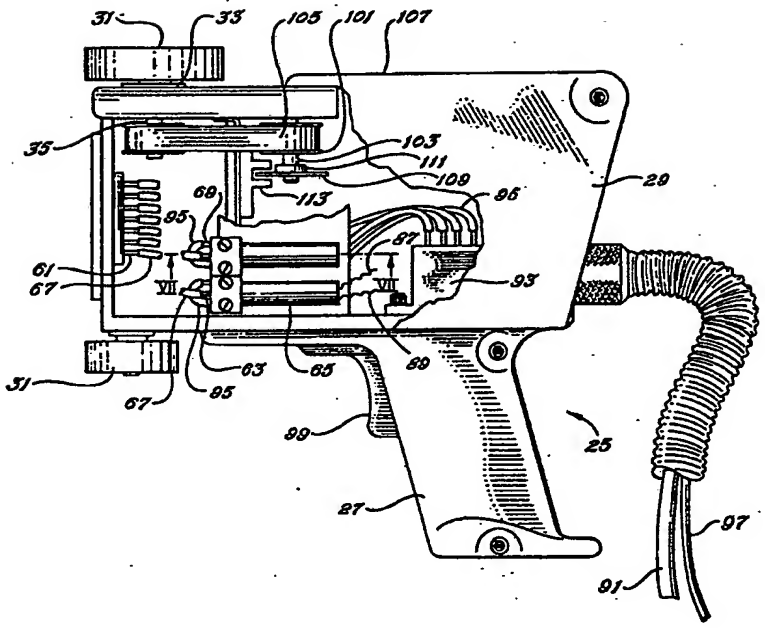
(54) **Hand-held printing apparatus.**

(57) A hand-held ink jet printing apparatus (11) is shown which has a carriage (13) adapted to be held in the hand of the user. Wheels (31) on the carriage (13) allow the carriage (13) to be moved over a surface to be printed. A plurality of nozzles (37) located in a common nozzle block (39) mounted on the carriage (13) are connected to a plurality of electrically operated solenoid valves (65) which supply ink to the nozzles (37). A microcomputer (17) remote from the carriage (13) controls the operation of the electrically operated solenoid valves (65). An encoder disk assembly (109) mounted on the carriage (13) and driven by the wheels (31) supplies electrical signals to the microcomputer (17) indicative of the rate at which the carriage (13) is moved over the surface to be printed.

EP 0 036 295 A2

./...

Fig. 2


31
33
105
101
107
35
103
111
109
29
113
96
69
95
87
61
67
VII
VII
93
31
63
65
89
67
95
99
25
27
97
91

HAND-HELD PRINTING APPARATUS

This invention relates generally to hand-held printing apparatus and specifically to a hand-held ink jet printing apparatus for printing alpha-numeric characters onto a suitable printing substrate such as a large container.

At the present time, there is a need for a relatively compact and convenient hand-held printing apparatus which can replace stencils for printing alpha-numeric characters, e.g., manufacturers codes or part numbers, addresses or ports of destination, or other legends or information on crates, cartons, containers, or the like, Although printing devices exist for use in packaging lines where containers move past a printing station on a conveyor, such devices are generally fixed in position and are not adaptable for portable use. In addition, such prior devices were often complex in design and used only parts which had to be specially manufactured with the result that the apparatus tended to be extremely costly.

SUMMARY OF THE INVENTION

It is, therefore, an object of the present invention to provide a hand-held printing device for applying alpha-numeric characters to cartons, boxes, and the like which is compact and conveneint to use.

Another object of this invention is to provide a hand-held printing device which is simple in design and can be manufactured from commercially available parts.

The hand-held printing apparatus of the present invention has a carriage adapted to be held in the hand of the user. Rollers mounted on the carriage allow the carriage to be moved over a surface to be printed such as the exterior of a container. Ink jet printing means are mounted on the carriage and are controlled by an electrical control means remotely located from the carriage. Signal generating means mounted on the carriage supply electrical signals to the electrical control means indicative of the rate at which the carriage is moved over the surface to be printed by the user.

In the preferred embodiment, a plurality of nozzles are located in a common nozzle block mounted on carriage. Electrically operated solenoid valves associated with each nozzle control the supply of ink to the nozzles. A microcomputer remotely located from the carriage controls the operation of the solenoid valves. An encoder disk assembly mounted on the carriage and associated with the rollers supplies electrical signals to the microcomputer which indicate the rate at which the carriage is moved over the printing surface.

The nozzles in the common nozzle block are preferably arranged in a single row in alignment with and at equally spaced intervals from one another. The nozzles are jeweled orifice nozzles having orifices in the range of 0.025mm to 0.215mm in diameter. The electrical cycle time of the electrically operated solenoid valves is in the range of 0.1 to 10 milliseconds. The encoder disk assembly has an

encoder disk which is mounted on a drive shaft and a photodetector subassembly. The drive shaft of the encoder disk is driven by the movement of the wheels over the printing surface. The ink jet printing means are connected to a source of ink under pressure remote from the apparatus by a flexible conduit. The remotely located electronic control means is connected to the ink jet printing means by a flexible electric cable.

Additional objects, features, and advantages of the invention will be apparent in the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is perspective view of the device of this invention being used to apply a label to a container.

Fig. 2 is a side view of the hand-held unit with portions broken away.

Fig. 3 is a front perspective view of the hand-held unit.

Fig. 4 is an isolated view of the signal generating means of the device of Fig. 1.

Fig. 5 is a schematic diagram of the electrical control means of the device of Fig. 1.

Fig. 6 is a cross-sectional view of the nozzle block of the device taken along lines VI-VI in Fig. 3.

Fig. 7 is a cross-sectional view of a valve used in the device taken along lines VII-VII in Fig. 2.

Fig. 8 is a front isolated view of one of the nozzles used in the nozzle block of the device.

Fig. 9 is a close-up view of the ink source of the device partially broken away.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to Fig. 1, there is shown a hand-held printing apparatus of the present invention illustrated generally as 11. The hand-held printing apparatus 11, has a carriage 13 adapted to be held in the hand of the user which is connected by flexible cable 15 to a remotely located electrical control means 17 and remote source of pressurized ink 19. Although the remotely located electrical control means 17 and ink source 19 are shown mounted on a wagon or dolly 21 it should be understood that the same could be mounted in a pack which would be worn by the user 23.

Referring now to Fig. 2, the hand-held unit is designated generally as 25 and includes a handle 27 extending from a generally rectangular carriage or housing 29. Roller means such as wheels 31 are mounted on the carriage for moving the carriage 29 over a surface to be printed such as a box or container. Wheels 31 are mounted on carriage 29 by suitable bushings 33 and an axle 35.

As shown in Fig. 3, an ink jet printing means is mounted on the carriage and includes a plurality of nozzles 37. Nozzles 37 are preferably located in a common nozzle block 39 which fits within a slot 41 in the front wall 43 of carriage 29. Nozzles 37 are preferably aligned in a single row which extends laterally of the direction of movement of the carriage 29 over the surface to be printed. As can be seen in Fig. 3, the nozzles 37 are located between the paths of travel of wheels 31 so that when the apparatus is in use the wheels 31 will not pass over any printing produced on the printing surface by the ink jet printing means. A follower wheel 45 can be provided to add stability to the carriage as print is being applied or wheels could be provided at four corners of the carriage 29.

Each nozzle 37 comprises a single aperture for the passage of ink. Alternatively, each nozzle 37 can comprise a plurality of apertures which provide the same cross-sectional area as the single aperture. The nozzles 37 are

preferably jeweled orifice nozzles such as the sapphire jewels used in acetylene torches and the like. Each jeweled orifice nozzle as shown in Fig. 6 and 7 has a generally circular body 47 having an orifice 49 of relatively smaller diameter on one face 51 and an opening 53 of relatively greater diameter on the opposite face 55. The diameter of orifice 49 is in the range of 0.025mm to 0.215mm, and preferably is in the range of 0.145mm to 0.185mm.

As shown in Fig. 6, each nozzle 37 is set in a nozzle block 39 preferably made of an inert material such as a suitable plastic. The nozzle block 39 has a series of generally circular recesses 57 having an internal diameter selected to receive the external diameter of the nozzle bodies 47. Recesses 57 are of sufficient depth to allow the nozzles 37 to fit flush with the top surface 59 of the block 39 when the nozzles are in place. The nozzles 37 are placed in recesses 57 with the opening 53 being first to enter the recess 57. The distance between the center of each orifice 49 when the orifices are vertically aligned is in the range of 0.01mm to 5.0mm and preferably is in the range of 0.05mm to 0.50mm.

A series of rigid tubes 61 lead from the nozzle recesses 57 in block 39 and project outwardly from the side of block 39 opposite recesses 57. Tubes 61 and hence nozzles 37 are each in fluid communication with the output port 63 of a valve 65 (Fig. 2) located within the carriage 29 by means of fluid conduits 67. Conduits 67 are of any suitable commercially available conduit, e.g., of metal or plastic material and are preferably in the range of 0.127mm to 1.270mm in diameter.

Valves 65 may be any suitable commercially available fast acting valve having an electrical time in the range of from 0.1 to 10 milliseconds, preferably in the range of 1.0 to 4.5 milliseconds. Suitable valves can be either a single-acting spring return, a double-acting electromagnetic

solenoid valve or a piezoelectric valve. Preferably a single-acting spring return solenoid valve such as is shown in Fig. 7 is used. Such a valve 65 typically has an output port 63 and an input port 69 leading to a fluid chamber 71 within an outer housing 73. A plunger 75 closes off output port 63 when in the position shown and has an elongated body 77 which is slidably received within a solenoid coil 79 held in place by mounting collars 81, 83. The solenoid coil and valve housing 73 are preferably coated with a suitable epoxy resin to prevent ink fluid damage.

The solenoid coil 79 when energized exerts an electro-magnetic force on plunger body 77 to cause the plunger 75 to move out of sealing engagement with the output port 63, allowing ink to flow out the output port. A spring 85 mounted between collar 81 and plunger 75 urges the plunger 75 into sealing engagement with the output port 63 and thus prevents the flow of ink from the fluid chamber 71 when solenoid coil 79 is de-energized. Wires 87, 89 run from solenoid coil 79 to the control circuit of the electrical control means 17 by way of a flexible electrical cable 91.

The input ports 69 of valves 65 are each in fluid communication with a common ink manifold 93 by means of fluid conduits 95 which are similar to fluid conduits 69. Ink manifold 93 communicates with the pressurized ink source 19 (Fig. 1) by means of a flexible ink line 97. The pressurized ink source 19 can comprise a reservoir and pressure means such as a vibrator pump to supply air pressure to the reservoir. An on-off switch 99 on handle 27 is provided between solenoid valves 65 and the electrical control means 17.

As shown in Fig. 2 and 4, a timing pulley 101 is mounted in carriage 29 on a drive shaft 103. Timing pulley 101 is connected to and driven by axle 35 of front wheel 31 by means of timing belt 105. The end of drive shaft 103 opposite carriage wall 107 has an encoder disk

109 mounted thereon by suitable bushings 111 said encoder disk being associated with a photo detector assembly 113.

As best seen in Fig. 4, photo detector 113 includes an elongated bar 115 having a side flange 117 in which is mounted a light source 127 and a matching side flange 119 in which is mounted a photo electric sensor 129. Encoder disk 109 is suitably positioned on drive shaft 103 so that the path of travel of holes 121 along the outer periphery of disk 109 is in the path of light from the light source 127 in flange 117 and the photo detector 129 located in flange 113. Electrical leads 123, 125 running from the photo detector subassembly 113 to the electrical control means 17 carry electrical pulses created by the movement of disk 109 and holes 121 through the light beam 131 between the source 127 and the photo cell 129.

In this manner, the spacing between holes 121 on encoder disk 109 can be correlated to the distance between the columns of print generated by the electrical control means 17 on the printing surface. The ink jet printing device 25 prints a column through nozzles 37 when a hole 121 or select number of holes comes into the view of the photo detector subassembly 113. Encoder disk 109 and photo detector subassembly 113 thus comprise signal generating means associated with wheel 31 for supplying to the microcomputer electrical signals indicative of the rate at which the carriage 29 is moved over the surface to be printed. Although an encoder disk and photo detector subassembly have been shown, other signal generating means can be utilized such as fluidic or electro-magnetic to perform the same function.

The source of pressurized ink 19 is shown in greater detail in Fig. 9. Pressure means such as a vibrator pump 135 supply air pressure through a hose 137 to a reservoir 133 which is filled with ink from the top by means of a cap 139. Pump 135 is suspended within reservoir housing 141 by means of resilient bands 143. A vent

valve 145 in air hose 147 allows the air pressure to reservoir 133 to be adjusted. Air pressure in the range of 0.5 to 7 psi is acceptable for the present purpose. A filter 149 can be utilized to filter the ink passing through ink line 97 to manifold 93.

The operation of the present invention will now be described in greater detail. The operation of the electrical control means 17 is shown schematically in Fig. 5. Movement of the hand-held unit 25 by the user across the surface to be printed causes axle 35 (Fig. 2) attached to wheel 31 to rotate. Rotation of axle 35 causes corresponding rotation of drive shaft 103 through belt 105. Movement of drive shaft 103 causes holes 121 in encoder disk 109 (Fig. 4) to pass between the light source 127 and photo cell 129 which are mounted in the opposing flanges 117, 119 of photo detector subassembly 113. Interruption of light beam 131 causes electrical pulses to be sent through lines 123, 125 to the microcomputer 17 indicative of the speed in which the hand-held unit 25 is being moved over the printing surface.

Microcomputer 17 has been programmed by the user through an input device 151 (Fig. 5) to direct the printing of a desired character message on the printing surface. The control circuit of microcomputer 17 is electrically connected to the solenoid valves 65 (Fig. 2). Valves 65 are thus selectively and intermittently actuated by the microcomputer 17 to allow ink to flow from manifold 93 through output ports 63 to jeweled orifice nozzles 37 and onto the printing surface. The selective actuation of valves 65 by the microcomputer 17 as the carriage 29 is moved over the printing surface allows a message to be printed in dot-matrix format with columns of the dot-matrix being printed only when holes 121 in encoder disk 109 are aligned with light beam 131.

An invention has been provided with significant advantages. The ink jet printing apparatus is suitable for printing large size alpha-numeric characters on a printing surface such as that of a container in a

warehouse and is portable and compact. The device is also simple in design and utilizes commercially available parts making it economically feasible for the intended application.

While the invention has been shown in only one of its forms, it should be apparent to those skilled in the art that it is not so limited but is susceptible to various changes and modifications without departing from the spirit thereof.

Claims:

1. A hand-held ink jet printing apparatus, comprising:

a carriage adapted to be held in the hand;

roller means on said carriage for moving said carriage over a surface to be printed;

ink jet printing means mounted on said carriage;

electrical control means remote from said carriage for controlling the operation of said ink jet printing means; and

signal generating means mounted on said carriage for supplying to said electrical control means electrical signals indicative of the rate at which said carriage is moved over said surface to be printed.

2. A hand-held ink jet printing apparatus according to claim 1, wherein said ink jet printing means comprises a plurality of nozzles mounted on said carriage and electrically operated valve means associated with each nozzle for controlling the supply of ink thereto.

3. A hand-held ink jet printing apparatus according to claim 2, wherein said plurality of nozzles are located in a common nozzle block mounted on said carriage and said valve means comprise electrically operated solenoid valves associated with each nozzle for controlling the supply of ink thereto.

4. The hand-held ink jet printing apparatus of claim 2 or 3, wherein said nozzles are arranged in a single

row in alignment with and at equally spaced intervals from one another, said row extending laterally of the direction of movement of said carriage over said surface to be printed.

5. The hand-held ink jet printing apparatus of claim 2, 3 or 4, wherein said nozzles are jeweled orifice nozzles having orifices in the range of 0.025mm to 0.215mm in diameter.

6. The hand-held ink jet printing apparatus of claim 5, wherein said nozzle orifices are in the range of 0.145mm to 0.185mm in diameter.

7. The hand-held ink jet printing apparatus of claim 5 or 6, wherein the distance between the centre of each orifice when said orifices are aligned is in the range of 0.05mm to 0.50mm.

8. The hand-held ink jet printing apparatus of claim 5, 6 or 7, wherein the electrical cycle time of said electrically operated solenoid valves is in the range of 1.0 to 4.5 milliseconds.

9. A hand-held ink jet printing apparatus according to any one of the preceding claims 2 to 8, comprising a microcomputer remote from said carriage for controlling the operation of said electrically operated valve means and an encoder disk assembly mounted on said carriage and associated with said roller means for supplying to said microcomputer electrical signals indicative of the rate at which said carriage is moved over said surface to be printed.

10. The hand-held ink jet printing apparatus of claim 9, wherein said encoder disk assembly comprises an encoder disk and photo detector subassembly, said encoder disk being mounted on a drive shaft which is driven by said roller means.

0036295

Fig. 1

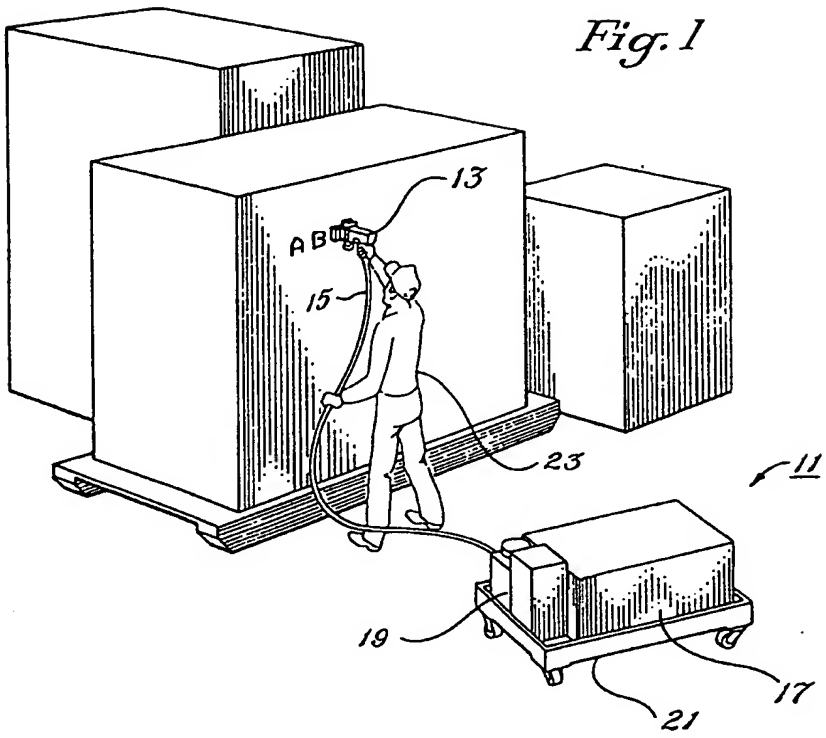
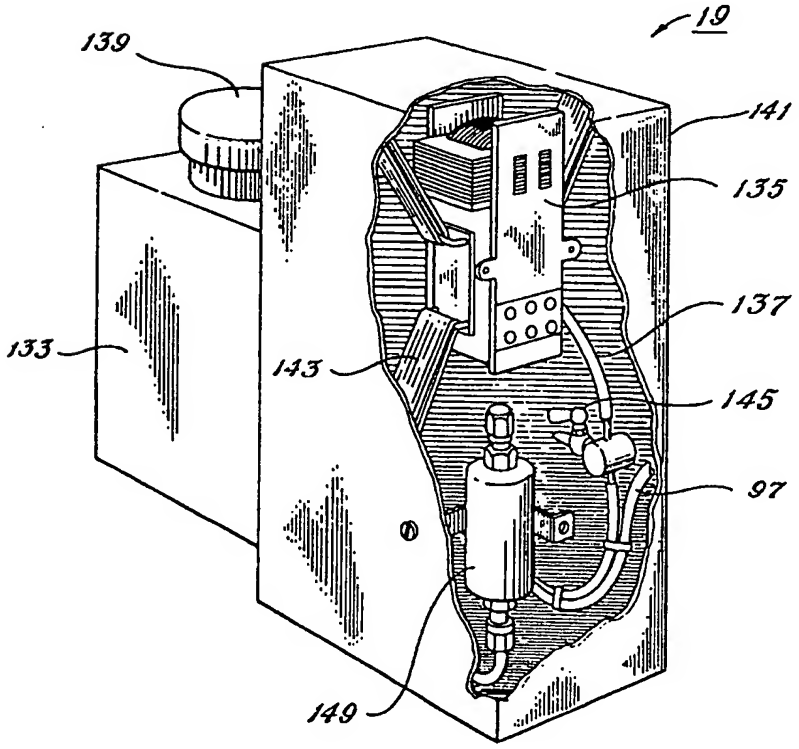


Fig. 9



0036295

Fig. 2

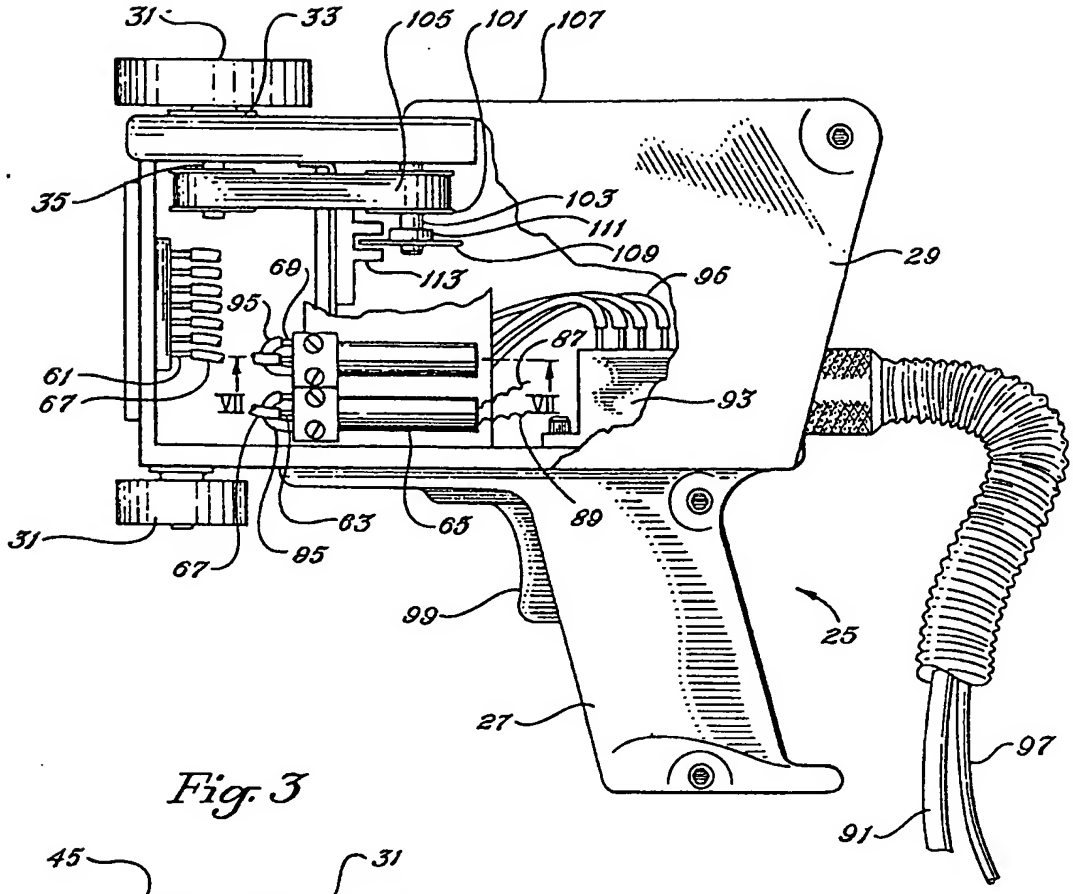
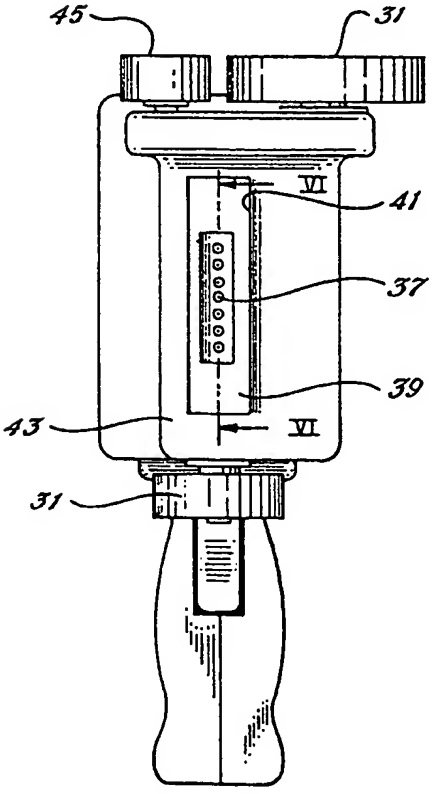


Fig. 3



0036295

Fig. 4

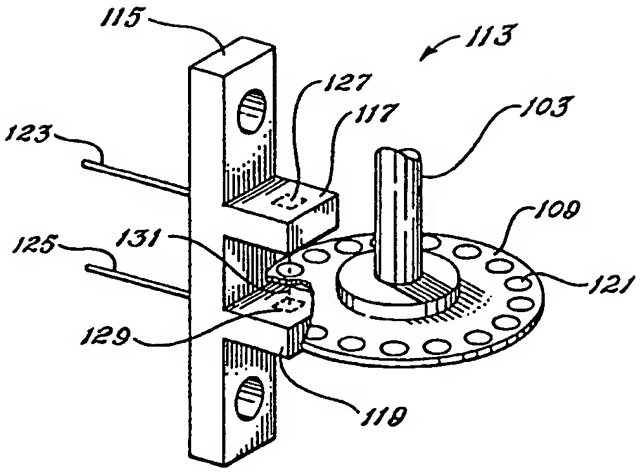


Fig. 8

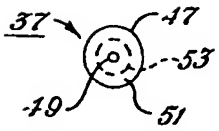


Fig. 6

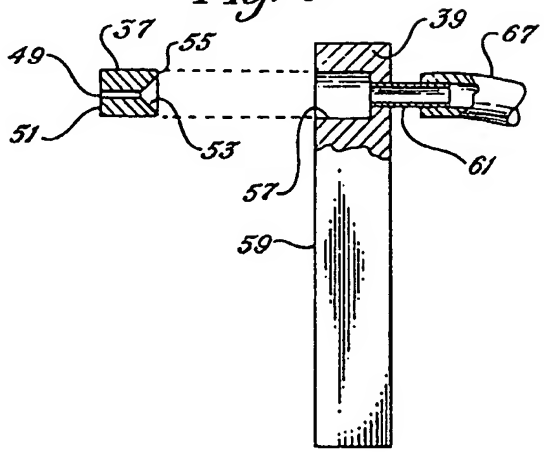
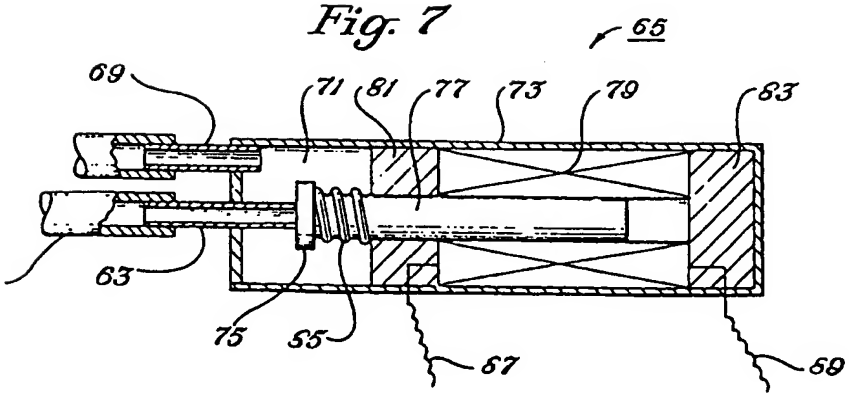
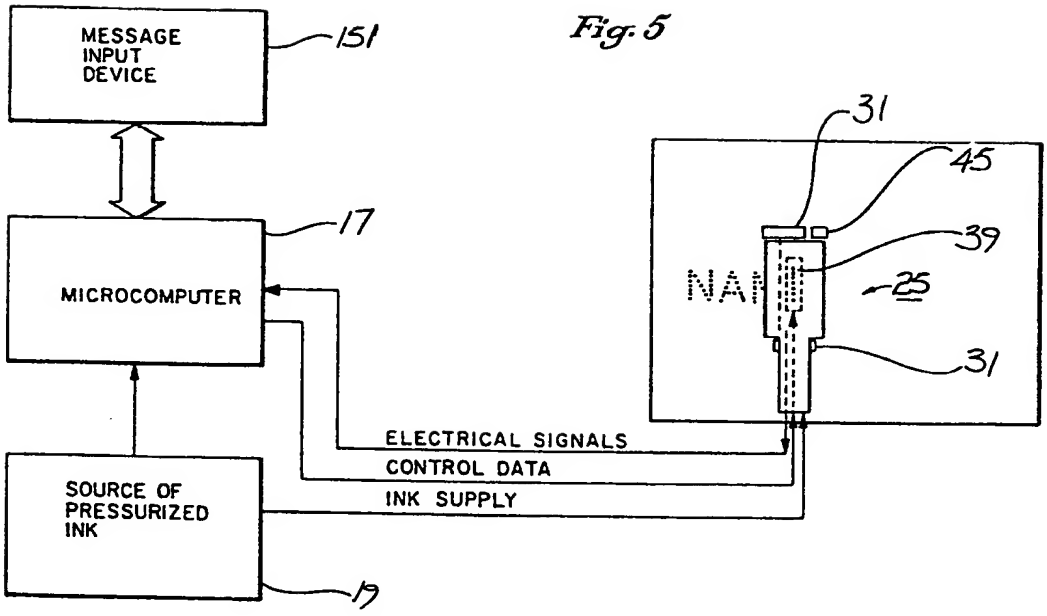


Fig. 7



0036295

Fig. 5



(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 036 295**
A3

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: 81301030.3

(51) Int. Cl.³: B 41 J 3/04

(22) Date of filing: 12.03.81

(30) Priority: 14.03.80 GB 8008794

(43) Date of publication of application:
23.09.81 Bulletin 81/38

(88) Date of deferred publication of search report: 07.10.81

(84) Designated Contracting States:
AT BE CH DE FR GB IT LI LU NL SE

(71) Applicant: PRINTOS B.V.
Energiestraat 1-3 P.O. Box 5029
NL-1410 AA Naarden(NL)

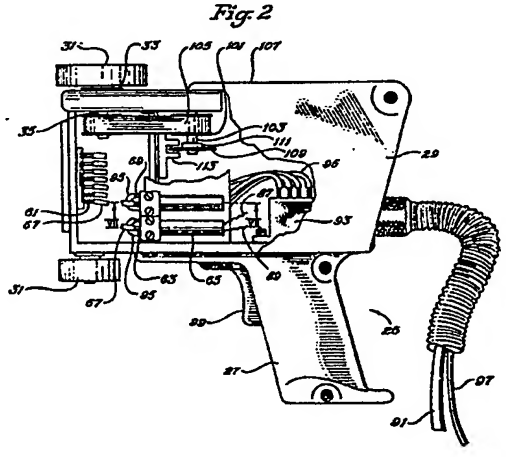
(72) Inventor: Cross, Grant Paterson
M/V Dimcyl Harefield Road
Rickmansworth Hertfordshire(GB)

(74) Representative: Sheader, Brian N. et al,
ERIC POTTER & CLARKSON 5 Market Way Broad Street
Reading Berkshire, RG1 2BN(GB)

(54) **Hand-held printing apparatus.**

(57) A hand-held ink jet printing apparatus (11) is shown which has a carriage (13) adapted to be held in the hand of the user. Wheels (31) on the carriage (13) allow the carriage (13) to be moved over a surface to be printed. A plurality of nozzles (37) located in a common nozzle block (39) mounted on the carriage (13) are connected to a plurality of electrically operated solenoid valves (65) which supply ink to the nozzles (37). A microcomputer (17) remote from the carriage (13) controls the operation of the electrically operated solenoid valves (65). An encoder disk assembly (109) mounted on the carriage (13) and driven by the wheels (31) supplies electrical signals to the microcomputer (17) indicative of the rate at which the carriage (13) is moved over the surface to be printed.

Fig. 2



EP 0 036 295 A3

0036295

European Patent Office

EUROPEAN SEARCH REPORT

Application number
EP 81301030.3

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
A	US - A - 3 656 169 (TOSHIO)	

CLASSIFICATION OF THE APPLICATION (Int. Cl.³)

B 41 J 3/04

TECHNICAL FIELDS SEARCHED (Int. Cl.³)

B 41 J 3/04
G 06 K 15/00
G 01 D 15/00

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

&: member of the same patent family, corresponding document

X The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	21-07-1981	KIENAST